

## SPAWNING SEASONS AND GROUNDS OF *DAYSCIAENA ALBIDA* (CUVIER, 1830) IN INDIA'S LARGEST BRACKISH WATER LAGOON, ODISHA, INDIA

Karna, S. K.<sup>1</sup> and S. Panda<sup>2</sup>

<sup>1</sup>Department of Zoology, Utkal University, Vani Vihar, Bhubaneswar, Orissa, India.

<sup>2</sup>Nandankanan Zoological Park, Mayur Bhaban, Shahid Nagar, Bhubaneswar, Orissa, India.

### Abstract

The spawning seasons and spawning grounds of the commercially important fish species, i.e. *Daysciaena albida* in the Chilika Lagoon were studied. For the experiment, the fish specimens were collected from two fish landing centers, i.e. Balugaon (central sector) and Kalupadaghat (northern sector) during the period of June 2008 to May 2009 on monthly basis. The peak spawning seasons of the species was estimated as the months of March to June. The resulted spawning grounds of the species in the lagoon are Sea, eastern part of Magarmukh and Lagoon mouth area.

**Keywords:** spawning season, spawning ground, *Daysciaena albida*, Chilika Lagoon, Orissa, India.

### INTRODUCTION

The development of reproductive characters, such as gonad and secondary sexual characters has long been employed as an index of sexual maturation in fishes, e.g., the gonosomatic index (GSI) is frequently used to determine the reproductive state of fishes [1,2,3,4,5]. Recent ecological approaches emphasize the importance of individual variations in behavior and morphology [6,7]. So, it is necessary to clarify variations in the development of reproductive characters of each season, sex and individual in relation to the mating period and behavior of the fish. Example, GSI value for ripe individuals has been traditionally used as an index of reproductive effort for a population or a species [8,9,10], but now individual variation in gonad weight is also important, since it indicates the difference in potential reproductive ability of each individual for producing or fertilizing eggs. *Daysciaena albida* ("Boroga" in local name), is a big sized Perch that inhabits Chilika lagoon frequently. The reproductive behavior of the fish has been reported a very long ago by Jhingran and Natarajan [11], which is very old and also insufficient. So, the present paper is an attempt to study in a same manner which will provide the information on a wide analysed data to better understanding about spawning seasons and grounds of the commercially important fish species, i.e. *D. albida* for the future management of their stocks and the conservation of critical areas.

### MATERIAL AND METHODS

#### Study area

Chilika Lagoon, the largest lagoon of India lies

in the east coast of India, situated between latitudes 19°28' and 19°54' North and longitude 85°05' and 85°38' East. It is designated as an important Ramsar site (No.229) of India on 1<sup>st</sup> October 1981. The water spread area of the lagoon varies between 906 km<sup>2</sup> to 1165 km<sup>2</sup> during summer and monsoon respectively. The estuarine lagoon is a unique assemblage of marine, brackish and fresh water eco-systems. The lagoon is divided into four ecological sectors namely, the southern sector, the central sector, the northern sector and the outer channel sector (figure-1) for scientifically better management of the ecosystem. Basically, the northern sector is fresh water dominated zone and central sector is brackish water zone. The southern sector is a higher saline area. The outer channel is marine in nature with saline water but during monsoon, the water becomes fresh due to discharge of flood water to the sea.

#### Spawning season

For maturity study, the fish specimens were collected from two fish landing centers of the lagoon, i.e. Balugaon (central sector) and Kalupadaghat (northern sector) during the period of June 2008 to May 2009 on monthly basis. Both the centers were selected on the basis of high fish landings throughout the year.

The sampled fish were dissected and the stages of maturity of the gonads were observed by eye according to the description by Pollard [12] shown in table-1. The gonad weight and the body weight without gut were measured by electronic balance. Then, the gonad somatic index (GSI) was calculated from the body weight and gonad weight;  $GSI = \frac{\text{Gonad weight (g)} \times 100}{\text{Body weight (BW) without gut (g)}}$ . In

total, 308 individuals of *D. albida* were examined for the experiment.

### Spawning grounds

GPS data logger (Model- TMS 20) survey was carried out to distinguish the similar ecological features in those areas, and finally the maps of the spawning grounds of the species prepared by using the GIS, "Marine Explore (Version 4.7)", and the satellite image (figure-5).

During the first week of every month, a total of 10 GPS Data loggers were fitted with 10 mechanized fishing boats (each boat with one Data logger) those were to go for their daily fishing to different fishing areas in the lagoon. When the fishing boats were moved the routes of the boats were recorded in the respective fitted GPS Data logger automatically. After completion of their scheduled fishing, they came to the fish landing centers, the GPS data logger collected. Again, from the fishing boat various needful data like species-wise catch details, fishing nets and meshes used for fishing were recorded. All the fish specimens caught by the particular fishing were collected and then transported to the laboratory for further biological analysis. In the laboratory, the fishes were dissected and the gonad status recorded. Then obtained data were co-related with the data of fishing grounds (from GPS Data logger) to know the exact status of the breeding and spawning of the species those are reflected in shape of maps (figure-5).

### RESULTS AND DISCUSSION

The maturity observation results and the monthly change of maturity stages (figure-2) and changes in Gonad Somatic Index (GSI) (figure-3) were shown. Concerning the maturity stages of the species, highly matured stages were found during February to June. Maturation stages 4 to 6, which are considered as the matured stages were found from the experiment during February to June. Even maturation stages 6 which are considered as the period of peak spawning were found among the specimens during March to June and very rare in July also. So, from the study of maturation stages, it is very clear that March-June is the peak spawning seasons for the species in the lagoon which is strongly supported by Jhingran and Natarajan [11] shown in table-3. Although the previous study reported the spawning period as April to July is narrowly differ to the present study but the previous one is about 40 years old, which may be the strong reason for this little

difference.

Considering the result of the GSI study, it was found that a gradual increasing trend in GSI value recorded from August to March. During March-June, high GSI value found and after that the value found very negligible. So the period of March-June might be considered as the peak spawning season for the species in this ecosystem. This study strongly supports the maturity status of the species with the previously studied maturity stages and the results of Jhingran and Natarajan [11] also.

GSI study and Maturity stage observation together, the peak spawning seasons of the species was estimated as March to June as shown in Table-2. This table also shows the spawning seasons of the species in the previous study report [11] and it seems that the spawning season of the species is slightly advanced one month as compared with the study of 40 years ago. This might be due to the environmental changes by global warming.

The map of the spawning grounds of the species in Chilika Lagoon, which was created on the basis of the results of the GPS data-logger survey, and the satellite images (figure-5). From the GPS-Data logger survey, it was found that the spawning ground of *D. albida* might be sea and the higher saline water area near Nalabana, eastern part of Magarmukh area and Mouth area of the lagoon. The results of the previous study [11] also recommended the same (table-3).

Table-2 shows monthly catch and the proportion (%) for the monthly total catch (sampling-base data) of the species in the fishing grounds near the estimated their spawning grounds. This shows strong seasonality. As shown in the table, there are high catches of *D. albida* recorded during the months of April to May in Magarmukha area and Nalabana Island area. Finally, Fig.5 showing the spawning ground of *D. albida* in Chilika lagoon designed as per the whole data available from the GPS-Data logger survey and monthly catch statistics in the fishing grounds. Considering the above-mentioned reports and the results from the present study, the high catches during the period of April-May in the areas in figure-4 seem due to its spawning migration.

Jhingran and Natarajan [11] observed mature specimens during April-July in the northern sector of the Lagoon which indicated that this fish breeds in the northern sector in summer months. This does not preclude its sea breeding which could be around March. By analyzing the

recruitment pattern of its fishery Jhingran and Natarajan [11] inferred that this species has two spawning peaks separated by a few months. The main peak spawning month, in their view, is May. Jones and Sujansingani [13] expressed their views that young ones of this fish probably migrate from the sea after the winter months. Kowtal [14] concluded that the fish breeds in the Tua Nali area off Borakudi Village in the

northern sector which was leased on collection of the developing eggs of this species and studies of its early development.

Salinity in the northern sector of the Chilika Lagoon gets increased considerably during the summer months (April-June) and the spawning period of this fish is most likely influenced by this environmental factor.

**Table-1:** Maturity stages and macroscopic descriptions of gonads (Pollard 1972).

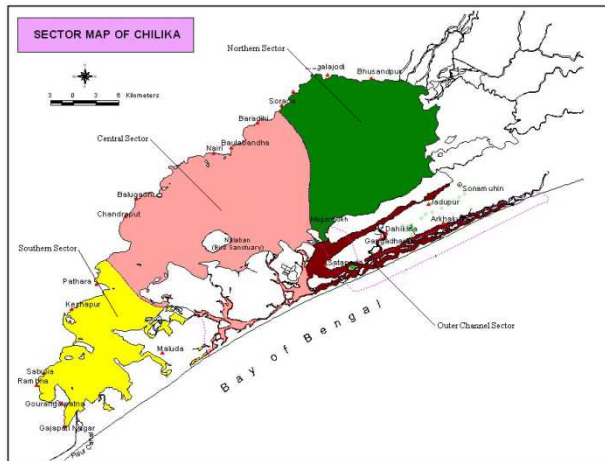
Maturity stages	Definition
Stage 1 (Immature)	Testis or ovary is thin and transparent. It is difficult to distinguish male and female.
Stage 2 (Initial developing)	Testis is thin, string-like, and grayish transparent. Ovary is a bit swollen and transparent. It is not possible to observe eggs with eye.
Stage 3 (Developing)	Testis is swollen, whitish, and smooth. Ovary is swollen and light yellowish. It is possible to observe eggs with eye.
Stage 4 (Maturing)	Testis is enlarged, whitish, and smooth. Ovary is enlarged, yellowish. Eggs become bigger.
Stage 5 (Mature)	Testis occupies most of body cavity. It is milky white and smooth. Ovary occupies most of body cavity. Its color is yellow. Eggs are big.
Stage 6 (Fully matured)	Testis occupies body cavity. It is white, smooth, and fragile. When press the abdomen, sperm flows out. Ovary occupies body cavity. Its color is light gold. When press the abdomen, eggs flows out.
Stage 7 (Spent)	Testis is thin, slackened, and grayish. Ovary is thin, slackened, and transparent.

**Table-2:** Monthly catch (kg) of *D. albida* in the fishing grounds near their spawning grounds (Sampling-base statistics, October 2007-September 2008).

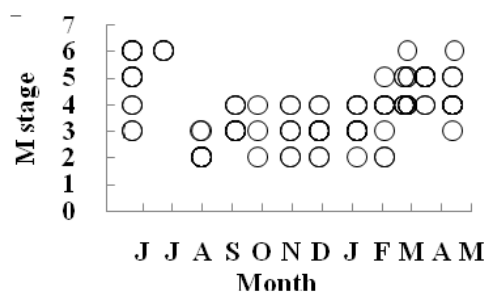
Area	Catch											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Magarmukh (in kg)	463	263	289	103	242	372	624	1031	364	386	256	140
% of total catch	40	34	46	33	49	46	43	50	29	49	34	13
Nalabana (in kg)	273	119	94	62	66	206	467	498	394	150	225	164
% of total catch	23	15	15	20	13	25	32	24	31	19	30	15
Other (in kg)	428	395	245	147	188	235	363	536	502	252	271	775
% of total catch	37	51	39	47	38	29	25	26	40	32	36	72
<b>Total catch (in kg)</b>	<b>1164</b>	<b>777</b>	<b>628</b>	<b>312</b>	<b>496</b>	<b>813</b>	<b>1454</b>	<b>2065</b>	<b>1260</b>	<b>788</b>	<b>752</b>	<b>1079</b>

**Table-3:** Spawning season and main spawning grounds of *D. albida* in Chilika lagoon.

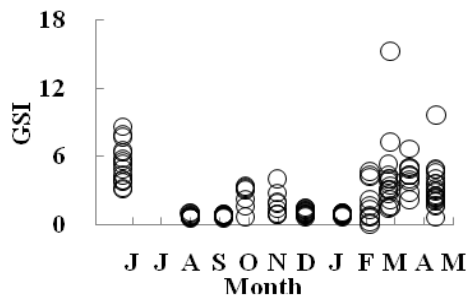
Type	Present Study	Jhingran & Natarajan (1969)
Spawning seasons	Mar-Jun	Apr-Jul
Spawning grounds	Sea, eastern part of Magarmukh, and Lagoon mouth area	Sea and Lagoon



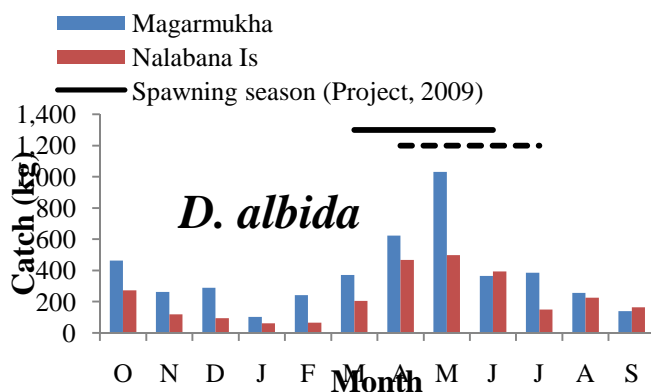
**Fig-1:** Map of Chilika lagoon showing four ecological sectors and fish landing centers.



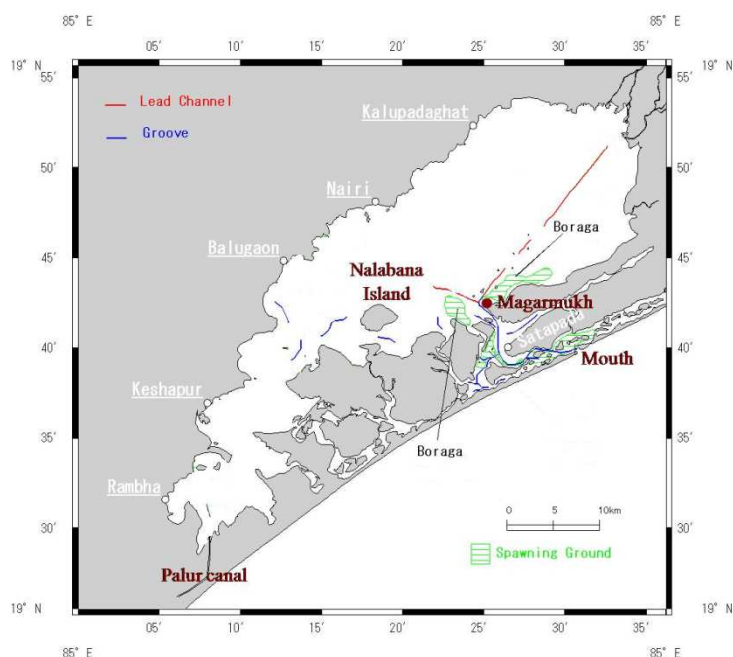
**Fig. 2:** Monthly change of maturity stages of the females of *D. albida*.



**Fig. 3:** Monthly change of GSI of the females of *D. albida*.



**Fig. 4:** Monthly catch of *D. albida* in the fishing grounds near the estimated their spawning grounds and the estimated spawning season (sampling-base catch data).



**Fig.5:** Map showing estimated spawning grounds of *D. albida* in Chilika lagoon.

## CONCLUSION

The information on the spawning season and spawning grounds is very important to carry out the fishery resources management of the commercially important species i.e., *D. albida* in Chilika Lagoon. This investigation could strongly help to the researchers and policy makers for the preparation of very effective sustainable management plans of fishery resources of the lagoon.

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